

Accelerator Safety Envelope

**Title of Facility: Tandem Van de Graaff and Tandem to Booster
Transfer Line**

Date of Initial ASE: December 1, 2001

Subsequent Revision Dates:

Version of the SAD that the ASE applies to:

1. Tandem Van De Graaff Safety Assessment Document, 10-01-1995,
<http://www.cadops.bnl.gov/AGS/Accel/SND/TVDGSAD/TVDGSAD.pdf>
2. Safety Analysis Report for the HITL to Booster Line, 10-07-1991,
<http://www.cadops.bnl.gov/AGS/Accel/SND/HTB.pdf>
3. TTB/TVDG Unreviewed Safety Issue, 10-01-2001,
http://www.cadops.bnl.gov/AGS/Accel/SND/tvdg_ttb_usi.htm

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Section 1. Introduction

General actions to be taken upon discovery of a violation of the Safety Envelope:

- 1.1. A variation beyond the boundaries described in Sections 2, 3 and 4 shall be treated as a reportable occurrence, as defined by [SBMS Subject Area on Occurrence Reporting](#). C-A Department staff shall make notifications of occurrences according to the requirements in the [C-A Operations Procedure Manual](#).
- 1.2. The method used by the Collider-Accelerator Department for change control of the ASE is documented in the [C-A Operations Procedure Manual](#).

Section 2: BNL Safety Envelope Limits

This section contains the absolute limits that BNL places on its operations to ensure that we meet the regulatory limits established to protect our environment, public and staff/visitors and that those operations are conducted within the assumptions of the TVDG/TTB safety analyses documented in the [TVDG/TTB SADs](#). BNL Safety Envelope Limits for TVDG/TTB operations are:

- 2.1. Less than 25 mrem in one year to individuals in other BNL Departments or Divisions adjacent to this Collider-Accelerator Department accelerator facility.
- 2.2. Less than 5 mrem in one year to a person located at the site boundary.
- 2.3. Offsite drinking water concentration and on-site potable well water concentration must not result in 4 mrem or greater to an individual in one year.
- 2.4. Less than 1250 mrem in one year to a Collider-Accelerator Department staff member.
- 2.5. Groundwater contamination from soil activation is to be prevented.
- 2.6. Airborne effluents from TVDG/TTB facilities shall not result in a dose that exceeds 0.1 mrem in one year to a person at the site boundary.

Section 3: Corresponding TVDG/TTB Safety Envelope Parameters

This section identifies the measurable limitations on critical operating parameters that, in conjunction with the specifically identified hazard control considerations established by the facility design and construction, ensure that TVDG/TTB operations will not exceed the corresponding TVDG/TTB Safety Envelope Limits discussed in Section 2. These parameters are derived from the safety analyses described in the safety assessment documents. TVDG/TTB safety envelope parameters are:

TVDG/TTB Beam Limits

- 3.1. The limit on the beam extracted from the TVDG or injected into the TTB shall be such that exposure to individuals in uncontrolled areas is likely to be less than 25 mrem in one year. For example, in the case of deuteron losses with 3 feet of earth shielding over the TTB tunnel, an uncontrolled area is maintained for 12 MeV deuterons with a pulsed-beam average-current less than 100 nA.
- 3.2. Beam limits for specific ions shall be proscribed in terms of beam energy and intensity before operations with the specific ion. These limits shall be set in writing by the C-A Department Radiation Safety Committee in order to meet the requirement in 3.1.

Control of Beam Loss

- 3.3. Loss monitoring results and radiation survey results shall be used in order to maintain beam loss "As Low as Reasonably Achievable" as defined in the [BNL Radiological Manual](#).
- 3.4. Planned beam-loss induced radiation in an occupied Controlled Area is to be less than 5 mrem in an hour and for repeated losses less than 100 mrem in a year.

Classification of Radiological Areas

- 3.8. Radiological area classifications during operations shall be in accord with requirements in the [BNL Radiation Control Manual](#).

Access Controls

- 3.9. The Access Controls System shall be functional during operations with beam.
- 3.10. During the running period, area radiation monitors that are interfaced with the Access Controls System shall be within their calibration date.
- 3.11. During the running period, the locations of area radiation monitors interfaced with the Access Control System are to be configuration controlled.

Fire Protection

- 3.12. Appropriate action shall be taken if fire detection/protection systems are impaired. These actions may either be to prohibit personnel from working in a specific area and/or to de-energize equipment.
- 3.13. TVDG/TTB magnets and power supplies may be energized if the smoke detection system for the energized area can transmit an alarm to summon the BNL Fire/Rescue Group. Transmittal may be automatic or via a fire watch.

Handling and Alerting System for Insulating Gas

- 3.14. TVDG accelerator tanks - The absolute maximum allowable working pressure for these vessels shall be 300 psig, as per ASME Code Stamp on the vessel.
- 3.15. The maximum working pressure for the insulating-gas storage-tanks shall be 575 psig.
- 3.16. The minimum allowable ambient temperature for the insulating-gas storage-tanks location shall be 32 °F.
- 3.17. The maximum working pressures for these vessels shall be as follows:
 - 3.17.1. Heat Exchangers: 250 psig @ 300 °F
 - 3.17.2. Dryer Towers: 250 psig @ 450 °F, 450 psig @ 250 °F
 - 3.17.3. Filter Towers: 250 psig @ 100 °F
- 3.18. Oxygen monitors that are used to alert against displacement of oxygen by insulating gas leaking into occupied areas shall alarm for oxygen levels below 19.5%.

Column Truss Structure

- 3.19. For MP6, the maximum additional column load that may be added to the original configuration shall be 5000 pounds concentrated at the high voltage terminal.
- 3.20. For MP7, the maximum additional column load that may be added to the original configuration shall be 3000 pounds concentrated at the high voltage terminal.

Beam Stop Power Limit

- 3.21. For TTB or TVDG, the maximum beam power on stops (the product of average beam current and energy) shall be no greater than 300 watts.

Section 4: Engineered Safety Systems Requiring Calibration, Testing, Maintenance, and Inspection

The systems and requirements for calibration, testing, maintenance, accuracy or inspections necessary to ensure the integrity of the TVDG/TTB safety envelope parameters during operations are:

- 4.1. The Access Control System shall be functionally tested in accordance with requirements in the [BNL Radiation Control Manual](#).
- 4.2. Accelerator building ventilation exhaust fans shall undergo annual testing (not to exceed 15 months).
- 4.3. TVDG/TTB fire protection shall undergo annual testing (not to exceed 15 months).
- 4.4. Area radiation monitors shall undergo annual testing (not to exceed 15 months).
- 4.5. Radiological barriers shall undergo annual visual inspection (not to exceed 15 months).
- 4.6. The insulating gas handling system shall undergo annual inspection and testing (not to exceed 15 months).
- 4.7. The oxygen monitoring system shall undergo annual inspection and testing (not to exceed 15 months).

Section 5: Administrative Controls

Administrative controls necessary to ensure the integrity of the TVDG/TTB safety envelope parameters during operations are:

- 5.1. Minimum Main Control Room Staffing
 - 5.1.1. C-A Main Control Room: one Operations Coordinator and one Operator shall be on duty when TTB beam is in operation. During normal operations, one of the two must remain in the Main Control Room at all times.
 - 5.1.2. TVDG Control Room: two qualified individuals are required for operation of the MP6 and/or MP7 Tandem accelerators. The operator-in-charge must be fully qualified and must be on-duty at the TVDG facility. The second operator is a person who is judged by the Pre-Injector Group Leader and TVDG Operations Supervisor, or in their absence the TVDG Operations Shift Supervisor, to have sufficient knowledge to assist the operator-in charge. The second operator must be on-duty at the C-A Complex and must

have radio communication with the operator-in-charge on-duty at the TVDG.

5.2. Experiment Area Staffing

5.2.1. The minimum experimental area staffing shall be a qualified TVDG operator for TVDG experimental operations with beam.

5.3. Operations staff shall be trained and qualified on their safety, operational and emergency responsibilities. Records of training and qualification shall be maintained on the Brookhaven Training Management System ([BTMS](#)).

5.4. Work planning and control systems shall comply with the requirements in the [C-A Operations Procedure Manual](#).

5.5. Environmental management shall comply with the requirements in the [C-A Operations Procedure Manual](#).

5.5.1. Groundwater monitoring well location and frequency of monitoring shall be reviewed periodically and adjusted based on prior measurement results.

5.6. Experiment modification and review shall comply with the requirements in the [C-A Operations Procedure Manual](#).

5.6.1. Each experiment in the TVDG Target Rooms shall be reviewed before running with beam.

5.7. Work on energized electrical systems shall comply with working hot permits and other controls in accord with the requirements in [SBMS](#).

5.8. Only qualified TVDG facility operators are authorized to operate the Tandem insulating-gas handling system and they shall comply with the requirements in the [C-A Operations Procedure Manual](#).

5.9. Modifications of the Tandem insulating-gas handling-system shall be reviewed by the Tandem Safety Committee and the approved by the C-A Accelerator Systems Safety Review Committee.

5.10. Modifications involving addition or removal of equipment from the column truss structures of the Tandem accelerators must be reviewed by the C-A Department Chief Mechanical Engineer, or his designee.

5.11. The Tandem Advisory Committee shall review beams with average power ratings greater than 200 watts.

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3. TTB/TVDG Unreviewed Safety Issue, 11-15-2001,
http://www.cadops.bnl.gov/AGS/Accel/SND/tvdg_ttb_usi.htm

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